Key Solution

CHEN 490 –Fundamentals of Petroleum Engineering
HW # 4 – Due T. 17/10/2014

1. How much tank oil exists in the following oil field?
   Area of field = 640 acres
   Average sand thickness = 20 ft
   Average porosity, ϕ = 20%
   Average connate water saturation, Swc =30%
   FVF for oil, B_o = 1.20

2. (a) Given the following data for a cylindrical core sample, compute the porosity.
   Clean, dry weight of sample = 311 gm
   Wt. of sample with pores completely filled (100 % saturated) with a 1.05 sp. gravity brine = 331 gm.
   Diameter of sample = 4.0 cm
   Length of sample =10 cm

   (b) What is the gross storage space exists in this rock ?

3. The sample of problem 2 was subjected to a laboratory linear flow test using distilled water as the flowing fluid. It is assumed that this did not alter the rock: the following data were obtained:
   Uw = 1cp P_1 =50 psig P_2 = 1 atm Pressure, 14.7 psia
   Q = 0.5 cc/sec length of sample = 10 cm
   What is the permeability of the sample ?

4. Compute the ideal production rate of the following well which was completed in the above sand.
   Spacing = 1 well per 40 acres
   Sand thickness 10 ft
   Static reservoir pressure, P_e = 2000 psia
   Bottom hole producing pressure Pw = 1500 psia
   Reservoir oil viscosity, μo = 3 cp
   Well diameter = 8 in.

thh – AUB – 7/10/2014

Date :

Name : Key Solution

Course : CHEN 490 HW 4

ON MY HONOR, I WILL NOT GIVE OR RECEIVE ANY ASSISTANCE ON THIS QUIZ OR EXAM.

Signature: _____

1. How much tank oil exists in the following oil field?

Area of field = 640 acres = 1 Section
Average sand thickness = 20 ft
Average porosity, ϕ = 20%
Average connate water saturation, S_{wc} = 30%
FVF for oil, B_o = 1.20

Solution:

$$N = \frac{7758 \phi A h (1-S_{wc})}{1.20}$$

$$= \frac{7758 (.20)(640)(20)(1-.30)}{1.2} = 11.6 \times 10^6 \text{ bbl}$$

2. a) Given the following data for a cylindrical cone sample, Compute the porosity.

Clean, dry weight of sample = 311 gm
Wt. of sample with pores completely filled (100% Saturated) with a 1.05 Sp. gravity brine = 331 gm
Diameter of sample = 4.0 cm, Length of sample = 10 cm

Solution:

$$\phi = \frac{V_p}{V_b}, \quad V_b = \pi (2)^2 (10) = 40\pi \text{ cc}$$

$$V_p = \frac{331-311}{1.05} = 19.05 \text{ cc}$$

$$\phi = \frac{19.05}{40\pi} = 15.1\%$$

b) What is the density of the rock grains?

$$\rho_s = \frac{311}{(.849)(40\pi)} = 2.0 \text{ gm/cc}$$

c) What is the gross storage space exists in this rock?

c) $V_p = (7758)(.151) = 1170$ bbl/acre-ft

3. The sample of problem 2 was subjected to a laboratory linear flow test using distilled water as the flowing fluid. It is assumed that this did not alter the rock. The following data were obtained:

$\mu_w = 1$ cp
$P_1 = 50$ psig
$P_2 =$ atm. pressure, 14.7 psia
$\frac{q}{A} = 0.5$ cc/sec = 10 cm
Length of sample
What is the permeability of the sample?

Solution:

$$K = \frac{\frac{q}{A}\mu L}{\Delta p} = \frac{(0.5)(1)(10)}{(4\pi)(50/14.7)}$$

$$= 0.117 \text{ md}$$

4. Compute the ideal production rate of the following well which was completed in the above sand.

Spacing = 1 well per 40 acres
Sand thickness = 10 ft
Static reservoir pressure $P_e = 2000$ psig
Bottom hole producing pressure $P_w = 1500$ psig
Reservoir oil viscosity, $\mu_o = 3$ cp
Well diameter = 8 in

Solution:

$$q_o = \frac{(7.07)(10)(0.117)(500)}{(3)\ln(700/.33)}$$

$$= 180 \text{ bbls/day}$$

Note: The drainage radius $r_e = 700$ ft slightly more than half the 1320 ft between 40 acre spaced wells. This is a common approximation.